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THE RENEWAL PROCESS AND OBSTACLES TO INNOVATION

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I. Introduction

This paper is concerned with maturity of business organizations and the process of renewal. So the question comes to mind as to whether maturity is inevitable, and whether the laws of human physical maturity and eventual decline and extinction also apply to business organizations. We must ask ourselves: "Are we possibly ascribing to business organizations attributes which apply to ourselves, and thus constraining our creativity and the growth of our organizations?" If so, the maturity of business firms and industries would be nothing more than an extension of our physiological limitations and a self-confirming expectation.

II. The Evolution of Firms and Industries

One of the greatest "inventions" in the history of mankind has been the corporate form of business organization. By use of this arrangement, financial resources far in excess of what a founder-entrepreneur and his/her family possess can be made available to the firm, making possible the realization of economies of scale, and the expansion of products as well as markets. Far and beyond all these benefits, however, the corporate form of business organization has provided a medium for the perpetuation of the firm and the creativity that drives it. This separation of the life of the

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business entity from the frailties of the founders and their families has paved the way for the phenomenal creativity and economic progress of the last century and brought about the high standard of living that all of us now enjoy. Certain entrepreneurs and family-owned firms realized succession for a while by bringing their heirs into the organization, but some others were not as successful. And it does not take too much empirical research to convince one that the "laws of evolution" are against the perpetutation of the family form of business organization. If, therefore, we accept the proposition that a business entity is a living organism subject to the same physiological limitations that govern the fate of human beings, the questions arises as to why some organizations succeed in perpetuating themselves and others do not?

It appears to me that the maturity of firms and industries, and I even dare say economies, is a relative phenomenon and that most likely it is caused by constraints that we as managers, engineers and scientists impose on our imagination.

Let us for a moment look at industrial history and draw some lessons. No one can ignore available empirical evidence that, in the United States, we have firms and industries that have matured and are declining. So that I may not alienate people and make foes out of friends, I will not mention specific firms by name, but instead I will concentrate on industries. Shoes, textiles, ships, steel, farm equipment, consumer electronics, automobiles, are but a few examples of industries where the United States was preeminent and lost its leading edge. In this sense these industries, in the United States, matured and declined. Japan, on the other hand, found ample

opportunity for growth in almost all of these industries, while the United States was languishing.

South Korea, Taiwan and Malaysia are now taking the leadership away from Japan in some of the areas responsible for the Japanese miracle. Growth industries of a few years ago are now "sunset" industries for Japan and orderly withdrawal from these markets is being planned. And this at the same time that those industries are considered golden opportunities in some other far-eastern countries.

Looking now at firms within industries, be these mature or growth, we find that some are growing at the expense of others. It would be a dull world, and one of uniform mediocrity, if every firm was doing exactly as well or as badly as its competitors.

The lesson that we draw from all this, is that for every mature industry there is at least one that grows; for every firm that declines there is at least one that thrives on the declining firm's miseries; for every challenged there a challenger; for every conquered there is a conqueror; and for every obsolescence, in a product, firm or industry, there is an innovative alternative that caused the obsolescence. In other words the phenomenon of maturity and decline more often than not is causally related to the emergence and growth of a substitute product, firm or industry. So what is it that drives certain organizations to success while others are failing?

We have heard recently a lot of arguments regarding the causes of the decline in U.S. industrial productivity and the most popular view is that the culprit is lack of capital formation and capital investment. While we may accept that we do not invest enough, it is not clear which is the cause and which the result. Are firms investing because they have innovative ideas and available

opoortunities for growth, or are the opportunities available to them because they invest? If the latter were true, then the more money a firm spends the more innovative ideas it would have. Well, the world is not that simple and we will do ourselves and our organizations a great disservice if we do not try to understand: "What is the cause and what the effect?"

At least in the case of the U.S. automobile industry, the evidence does not support the hypothesis that the problems were caused by lack of investment.[1] It is more likely that the culprit is lack of product innovation. The effective value per dollar of expenditure, by the average buyer, of a Japanese car appears to be far greater than that of an American car. That is one reason why imitation of the Japanese automobile manufacturing technology will not bring about any relief to the U.S. automobile industry. In fact, as I pointed out elsewhere[2], if all other things (such as product characteristics) are equal, exact imitation of a process technology which is optimal in one country is not necessarily so in another. And this, because the relative cost of the factors of production is most likely different. We all know that the cost of capital and labor is different in Japan from that in the United States. Unless therefore, the Japanese process technology is adapted to reflect the domestic input costs, the U.S. automobile firms which imitate it will put themselves at a permanent cost disadvantage.

So, the key appears to be value generating product innovation.

III. Organisms, Organizations, Data and Information

Before we proceed to analyze the impediments to innovation and change, it is necessary to distinguish between an organism and an organization and between data and information.

From a cybernetic viewpoint, an organism is not an

organization.[3] An organization is goal seeking, has a purpose, and can sustain itself without depending upon continuous input of information from the outside. An organism, on the other hand, depends on continuous input from the outside, without which it cannot function let alone change its structure in times of crisis. Organizations can be composites of goal-seeking organisms as long as the latter are self-organizing, and can survive by generating internally the information necessary to sustain themselves. Thus, in devising strategies for change and growth, organization structures and information systems are key ingedients to success.

Since information is so vital to the survival, restructuring and growth of organizations, it may be advisable to distinguish between data and information.

Data are the output of objective models such as the accounting system, and are universally accepted, because the majority of "experts" say so. Information on the other hand, is the meaning or intelligence that is derived when the date are put in an appropriate (associative) context. The associative contect is subjective and the more unique it is, the greater the potential comparative advantage it provides to those who possess it.

Models enable us to create some of the associative contexts which are necessary for sustenance, renewal and growth. Models are nothing more than abstract representations of the world we want to deal with and in the way we see it. Obviously, the greater the degree of detail the models provide, the greater the content and the more limited the meaning they impart. Also the more universal their acceptance in managerial decision making the more objective the models become, and the lower their potential for providing a

comparative advantage to the firm.

In the business world, sustenance and renewal can occur through innovation. Some firms obviously will do better in their efforts than others, although each one of them would like to be on the side of the spectrum where it does better than the average competitor. The only way this can be done is through better knowledge, powerful associative contexts, and more effective strategic management of resources. The latter, as I shall soon stress, involves a dynamic balance between specialization, and the concomitant aversion to change, and change itself.

IV. Obstacles to Innovation

Although we do not know exactly how innovation occurs, we see ample evidence that innovative talents exist widely and are not the monopoly of any one firm or industry. The specialization of individuals and firms, however, as well as the environment within which the work is carried out influence the associative context of individuals and the effective utilization of their creative talents. Many times we hear of people who leave their employment either because they feel that their creativity is being stifled within their organization or because they cannot convince their superiors of the value of their new product ideas. The history of the semi-conductor, electronics and computer industries is replete of examples of "spin offs" both successful and unsuccessful. A study, therefore, of the obstacles to innovation and the process of renewal is very instructive and for this reason we will concentrate on the impediments, after we say a few words about innovation itself, and its objectives.

A. Types of Innovation

There are two major types of innovation, product and process.

1. Product innovation addresses itself to those aspects of technology that create value to the product in use. In the final analysis it is the market place that decides as to whether a product innovation is successful or not, either because the functional characteristics of the new product are such as to merit a value which is greater than its relative selling price (inflated by the relevant switching costs) or because the new product has unique and completely novel characteristics whose value is assessed by the users as being greater than the cost to them of the new product.

In the process of developing a new product the firm may develop a core technology that applies to one product or to a family of products. Obviously the latter is more beneficial, if successful, because it can sustain the firm longer and enable it to make larger and more cost-effective investments in process innovation.

2. Process innovation is concerned with the technology the firm uses to produce its products and services. The aim is efficiency through specialization and is usually obtained by means of heavy investment of time and capital. The net effect is a reduction of the manufacturing cost of the product.

There is invariably a basic conflict in process innovation in that specialization is achieved at the expense of flexibility and independence. Heavy investment of time and money normally creates "fixities" and huge facilities which cause technical and technological interdependencies among the products and services using the facilities, at any moment in time and over the economic life-time of the facilities. So a miscalculation on the high side may result in a lower product cost at the beginning, but may inhibit the adoption of new process technology later on when it becomes

available. Also it may, as I will soon argue, get the firm locked in to an obsolete product. Underinvestment, on the other hand, may affect the initial profitability of the firm and erode some of its competitive advantage.

A synchronization of the product life cycle and that of the process technology is imperative. Unfortunately, within many firms these two classes of decision, product and process innovation, are usually made independently and serially. In fact, manufacturing-process decisions are often made as if the products have infinite life. One can readily conclude that the strategy of obsoleting one's product must dictate the nature and extent of manufacturing technology. The greater the uncertainty or turbulence impinging on the product, the greater the "labor" intensity of the product, because the economic environment does not encourage large investments in new manufacturing processes which will last, physically, for long periods of time but may soon become obsolete.

Critical proprietary aspects of process technology may be either found in the "head" of those using the technology or may be captured in instrumentation. There are several advantages to storing process technology in instrumentation expecially if it is complex. First of all, employees cannot easily pirate the technology of a firm and start up a business to compete with their previous employer. Then, one has the problems of bondage to certain employees and of consistency of quality, if uniformity in the application of technology is not possible. Finally, process instrumentation may become a product to be either sold or licensed. Licensing or selling process technology may be one of the best ways of locking in others to one's own technology and at the same time raising the cost

function of competitors, a comparative advantage not many firms exploit. Of course, one may say that the best comparative advantage is to keep technology secrets from competitors. If that can be done, fine; but more often than not competitors not only imitate enough to effectively compete but also improve on the innovation, rendering the originator obsolete.

B. Objectives of Innovation

The principal objective of innovation is the creation of a comparative advantage which enables the innovator to extract an economic monopoly rent. In other words, if a firm has an unique product or process which adds value to the user per dollar of cost, far in excess of what competitive products and processes do, the innovator should be able to get a higher price than the competitors.

In the case of product innovation, the product is differentiated and therefore not subject to price competition. At the same time it may be positioned in a niche which makes it insensitive even more so to price competition because the demand facing firms in such situations is very inelastic. Capitalizing on its technology and the characteristics of its product, the firm may erect barriers to entry for others and further insulate itself.

Similarly process innovation allows the firm to enjoy absolute cost advantages, to block the entry of others ususally through patents and low prices, and to increase in general the cost of entry of potential competitors.

Because product innovation addresses itself to the value in use and the demand of the product, its benefits normally last longer than those of process innovation. The comparative advantage gained through product innovation, in other words, is normally greater than that of process innovation unless the latter results in a product.

C. Types of Obstacles to Innovation

Our work at the M.I.T. Sloan School of Management [4] identified three major obstacles to innovation. These are associated, one each, with fixed investment, management, and labor, ands we refer to them as "critical fixities."

The investment fixity is caused by the heavy capital requirements that are normally associated with manaufacturing processes. We all know that economies of scale are mostly obtained through the specialization of resources, the major one of which is capital. Large amounts are invested in plant, machinery and equipment resulting in the loss of flexibility, as well as divisibility, and relating the cost of products and services over the life-time of the investment.

Most often the larger the fixed investment, other things equal, the lower the long-run average cost of the product. Also, the greater the cost fixity the lower the marginal cost (out-of-pocket or incremental cost) of using the facility for its orginally intended (designed) purposes. For example, large refineries, steel mills, utilities and assembly plants enjoy, at full capacity, a lower long-run average cost than their smaller counterparts. This lower cost is gained at the expense of flexibility and divisibility.

Taking now the short-run, the larger the facility and the more automated, the smaller is the out-of-pocket cost component of the total cost of the products produced. The same can be said about the incremental costs associated with the changes in volume and of operating versus shutting down the facilities.

It is a fundamental economic dictum that unless the long-run average full cost of a new facility or a new product (given same

value) is less than the out-of-pocket cost (marginal) of the old, no manager should make the investment. Incidentally, the cost of the challenger must also include all the necessary retraining and other switching costs. So, the greater the investment fixity, and as a result the lower the marginal cost, the more formidable are the economic obstacles to innovation and change.

It is an irony that the greater the investment miscalculation, induced by the desire to lower the long-run cost of the product, the lower normally is the marginal cost and the greater the aversion to change. So the greater the white elephant, the longer one tends to stay with it, for good economic reasons.

The second type of fixity is associated with management, and it also has its roots in specialization. The more we specialize, the more we gain in depth at the expense of breadth, and the more inflexible we become. Therefore, both the economic as well as the psychic costs are less in continuing on existing paths. This means that the switching cost and the fear of change become greater and greater as one specializes more and more.

Another consequence of specialization in depth and the loss of breadth relates to the associative context. It becomes more and more limited to our speciality. As a result, innovative ideas outside the area of our specialization are not likely to be generated or allowed to flourish. We are all familiar with the N.I.H. factor and the power of statements such as, "that's not the way things are done here."

The managerial fixity then affects innovation and change in two ways. First of all the switching costs and the fear of obsolescence may be so great as to create a barrier to change and, second, the innovative ideas may not be forthcoming from within nor will they

have much of any chance of success if brought from the outside.

Finally, the organization has to contend with the labor fixity. As in the case of the investment and managerial fixities, specialization is a two-edged sword. While it enables us to achieve economies, specialization of workers by function creates an aversion to change and serves as an impediment to innovation. It is very painful and difficult to successfully retrain people and switch them from one function to another, if they have for years concentrated on a very narrow specialty. The threat of obsolescence, the loss of comparative advantage and the psychic as well as the economic costs of switching and "starting all over again" make people fight change and impede the adoption of innovation.

From some cursory evidence that we have thus far, it appears that the probability of completing the retraining program is lower the longer a worker has been on the job. What is more, and even if a worker completes the retraining program, the probability of effectively applying the knowledge gained to the new activity appears to be minimal.

The switching costs, both economic and psychic, and the narrowness of the associative context, once again, become very formidable barriers to innovation and change.

To summarize, we have three critical fixities—investment, managerial and labor--which serve as obstacles to innovation. Managers by strategic design, must strike a balance between specialization and breadth, and determine as well as synchronize the life-cycles of the critical fixities. And this so that the organization is not plagued by dominant fixities that inhibit the innovative tendencies of the organization.

V. The Management of Complexity

Change induces complexity and many of us are afraid to deal with it. We must remember, however, that if we do not do anything about it, someone else will and may drive us out of business. If our competitors be they domestic or foreign can innovate, why can't we do so by plan rather than crisis? Why should we allow our competitors to decide the life-cycle stage of our organization?

Complexity is managed by applying to it appropriate information. And as we have already mentioned information is generated, perceived and conceived when data are placed in an appropriate associative context. The latter notion is very simple but at the same time extremely complex. It is an abstract notion with various (infinite) levels of abstraction for any given situation. Consciously or unconsciously managers use it everyday as they obtain signals from operations and attempt to derive meaning out of data.

At the risk of oversimplification, I will try to illustrate the dependence of information on the associative context, by drawing on some of the results of our work on productivity and innovation at the M.I.T. Sloan School of Management.[5]

Exhibits I and II present the traditional measurements of progress based on the accounting model of the firm. Using this context, one can derive information and arrive at the conclusion that G.M. has been progressing and increasing its productivity steadily since 1958, with the exception of 1970 when they had a strike, and 1974 and 1975 because of the "oil crisis."

While profits were going up, however, the share of imported cars increased by a factor of five in sixteen

years. The loss of market share provides information that G.M. and the U.S. auto industry were losing their comparative advantage and their monopoly rent, which is in conflict with the information provided by accounting short-term profitability.

If a firm or an industry effectively innovates, it derives a monopoly rent, which means that it can pass on to the customers all its cost increases and more. Effective product innovation allows one to do that because the value generated is far greater than the costs of obtaining it. Process innovation, on the other hand, aims at cost reduction leaving the value unaffected. If, therefore, a firm or an industry experiences cost increases per unit of product, it means (by definition) that it did not succeed in offsetting these by process innovation.

Exhibit IV indicates that G.M. lost its monopoly rent. It simply could not pass on to its customers the cost increases of the producers of the goods the automotive industry was using. On top of all this, of course, salaries, wages and benefits were increasing at a much faster pace thanboth new car prices and producer goods prices.

To enrich our associative context even more and derive better information about productivity through innovation at G.M., let us look at economic value added per dollar of payroll and benefits. Exhibit V indicates that since 1962 G.M. has been steadily losing its monopoly rent because product innovation was not adding enough value to offset the cost increases.

So if the data were put in the value-added context, rather than the traditional accounting associative context, the meaning would have been different. The declining trend in productivity would have been foreseen in the mid-sixties. Profits did not reveal any crisis information until the early 80's.

In conclusion, product innovation is the key to increases in productivity and growth. Maturity and decline are not inevitable, unless you as managers abdicate your responsibilities for bringing about change.

As managers you will have to manage technology, introduce change as part of your strategy and must, therefore, have a strategy for managing technological change.

Planned introduction of new products and the obsolescence of old by design, is a must, and so is the synchronization of product and process life cycles.

Human resource development must be treated as a strategic issue, and managed to enrich the associative-context capabilities of managers. This will minimize their fixity and switching cost; will enable them to effectively manage human and capital resources and protect your organization from the investment and labor fixities with all their detrimental consequences on innovation and change.

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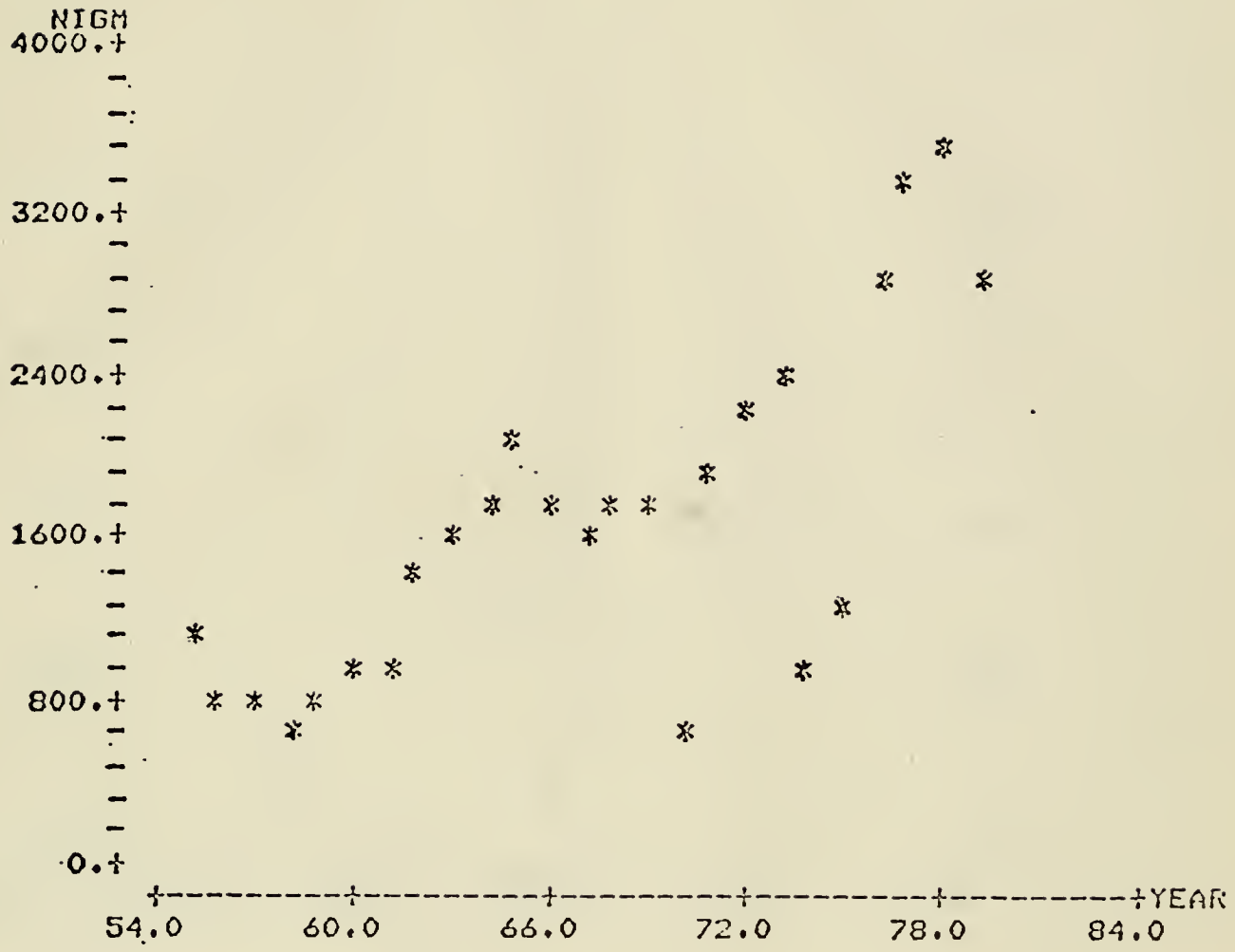
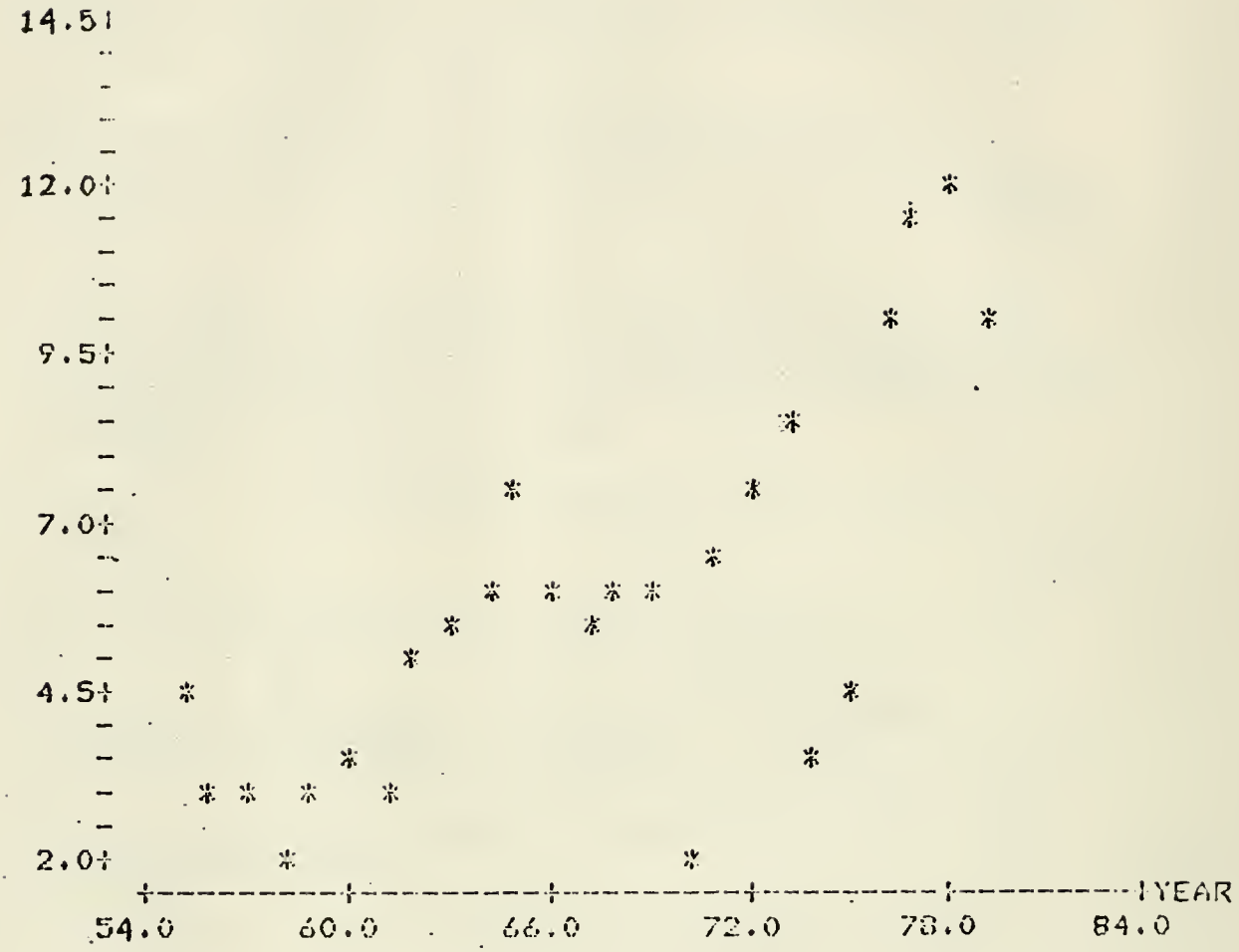
Exhibit I



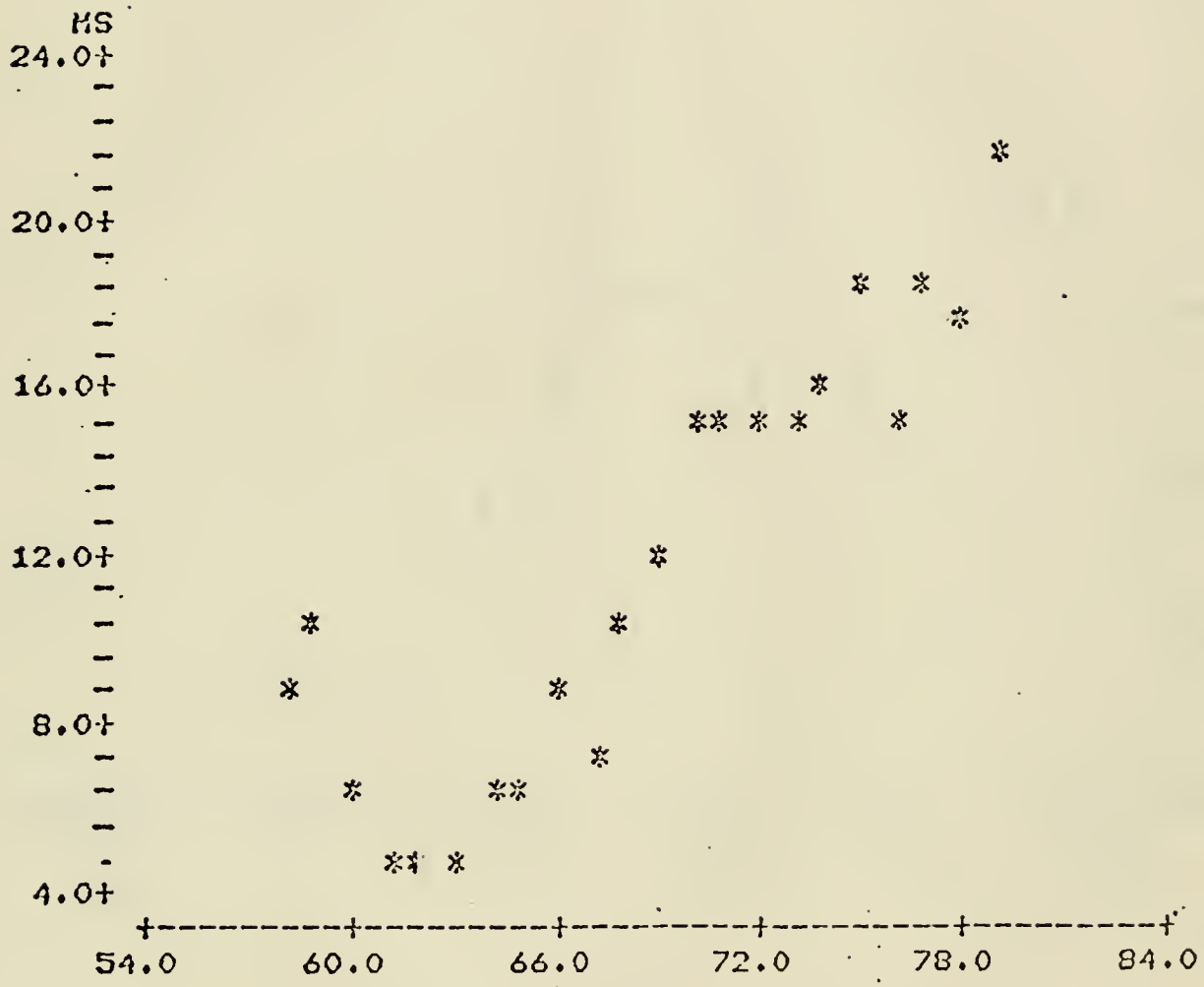
NET INCOME (GM)

Exhibit II



EARNINGS PER SHARE(CM)

Exhibit III

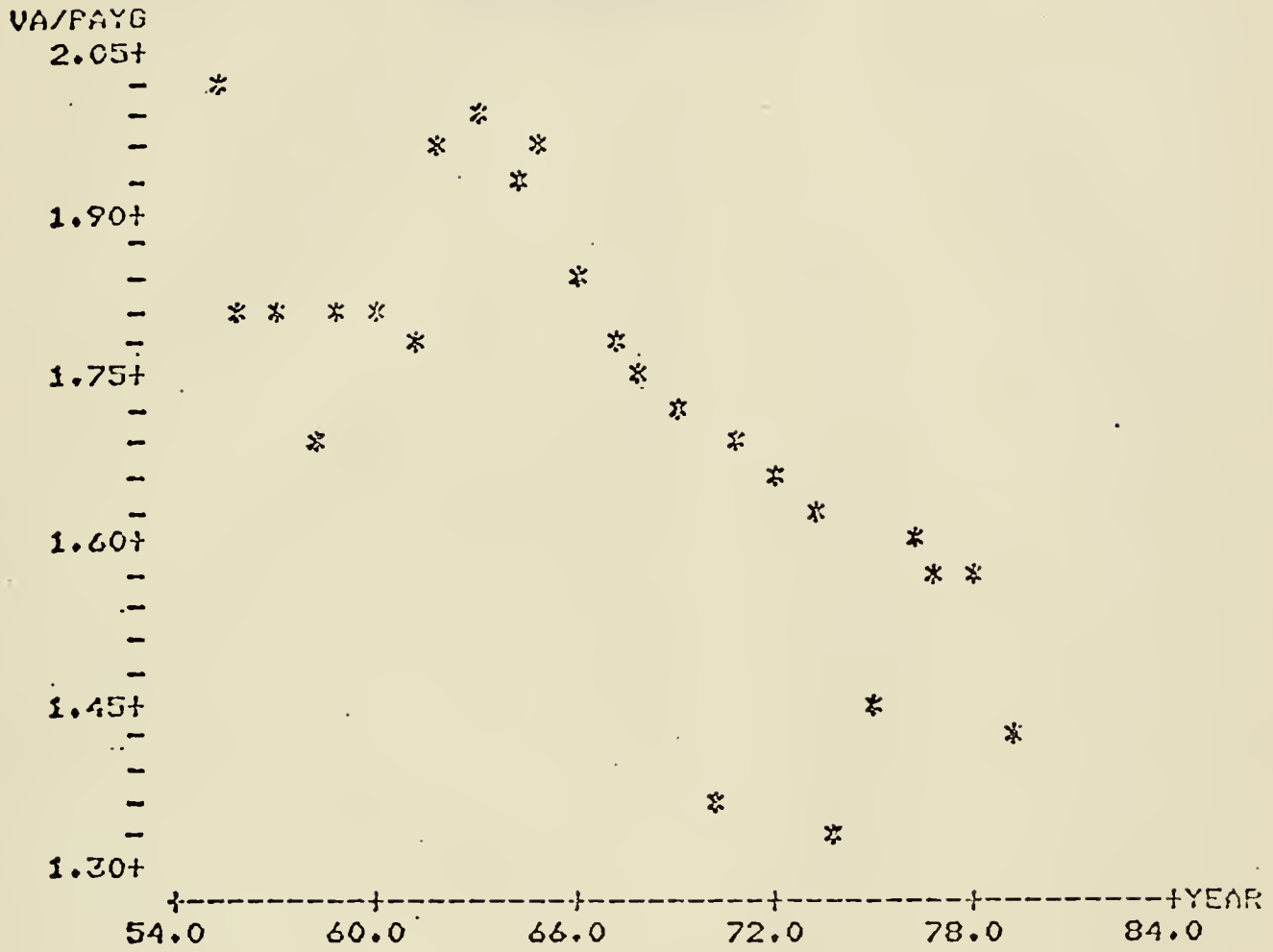


IMPORTED CARS MARKET SHARE

Exhibit IV

NEW CAR PRICE INDEX OVER PRODUCER PRICE INDEX (AUTOMOBILE INDUSTRY)

Exhibit V



VALUE ADDED OVER PAYROLL AND BENEFITS (GM)

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